Conflicted Minds: Recalibrational Emotions Following Trust-based Interaction

Eric Schniter [a, *]
Roman M. Sheremeta [b]
Timothy W. Shields [b]

[a] Economic Science Institute, Chapman University
One University Drive, Orange, CA 92866, U.S.A.
[b] Argyros School of Business and Economics, Chapman University,
One University Drive, Orange, CA 92866, U.S.A.

Version: June 5, 2013

Abstract

We investigated whether 20 emotional states, reported by 170 participants after participating in a Trust game, were experienced in a patterned way predicted by the Recalibrational Model. According to this dynamic model, new information about trust-based interaction outcomes triggers specific sets of emotions. Emotions, in turn, recalibrate the short-sighted or long-sighted programs in self and/or others that determine trust-based behavior propensity. Unlike Valence Models that predict reports of large sets of emotional states according to interdependent positive and negative affect alone, the Recalibrational Model predicts conflicted, mixed-affect emotional states. Consistent with the Recalibrational Model, we observed reports of mixed-affect (concurrent positive and negative) emotional states (e.g., strong simultaneous experience of triumph and guilt). We discuss the implications of having "conflicted minds" for both scientific and well-being pursuits.

JEL Classifications: C91, D87
Keywords: emotion, affect valence, recalibrational theory, Trust game, experiment

---

* Corresponding author (email): schniter@chapman.edu
We thank Rob Kurzban, Daniel Nettle, Nat Wilcox, Joaquín Gómez-Miñambres, and participants at the 2012 Human Behavior and Evolution Society meetings for helpful feedback. We are grateful to Chapman University and the Economic Science Institute for research support.

1. Introduction

The central aim of this paper is to investigate whether 20 emotions, reported by 170 participants after completing a Trust game and learning of its outcome, were experienced in a patterned way that conforms to predictions of our proposed "Recalibrational Model" or predictions of Valence Models. The Recalibrational Model predicts the experience of emotions according to several dimensions (short-sighted, long-sighted, positive, negative, interpersonal, and intrapersonal) while Valence Models often predict the experience of emotions according to a positive-negative affect dimension alone.

The Recalibrational Model, shown in Figure 1, describes a dynamic process in which the integration of new information (from trust-based decisions and interaction outcomes) triggers emotions. Emotions, in turn, recalibrate conflicting behavior regulation programs[1], which we call the "short-sighted" program (V), and the "long-sighted" program (U). The relative power of these programs determines the extent to which an individual's behavior in a trust-based interaction trades off the short-sighted goal (opportunism) for the long-sighted goal (developing a trust-based exchange relationship).

The first part of the proposed model (1.1 in Figure 1) describes how the relative calibration of short-sighted and long-sighted programs ultimately determines Investor and Trustee behavior propensity when individuals are confronted with a Trust game choice dilemma. The second part of the model (1.2 in Figure 1) specifies how emotions, acting jointly in sets to recalibrate the operation of short-sighted and long-sighted programs in both self and others, are triggered by new information about Trust game outcomes. These sets of emotions computationally identify and respond to the presence of specific adaptive problems based on Trust game decisions and outcomes. A third part of this model (1.3 in Figure 1), untested with this research, specifies the kinds of targeted recalibration effects (i.e., "positive" upregulation and/or "negative" downregulation of short-sighted and long-sighted programs) that we expect emotions to encourage, resulting in changes to behaviors in self and others.

[1] "Programs", from computational science, refers to neural circuits in the brain/body which process input information and accordingly cause outputs either in the form of regulatory feedback (reused as input by programs) or behavior. In support of our model, neural imaging studies provide confirmation of dual programs simultaneously activating in subject exposed to decision dilemmas (McClure et al. 2004; Hare et al. 2009). Internally conflicting programs with emotions as their co-evolved "guidance systems" may have been selected for because they can provide efficient solutions to the dynamic problems of changing environments (Tooby & Cosmides 1992; Livnat & Pippenger 2006).

We used the various recalibration functions, proposed for the 20 emotions studied, to determine how specific emotional states fit into five unique sets of the Recalibrational Model. Consistent with the premise of competing programs in humans' "conflicted minds", we observed participants frequently reporting mixed-valence emotional states (e.g., simultaneously experienced triumph and guilt). Mixed-valence emotional states are not predicted by simpler models still *de riguer* today, such as the bipolar affect Valence Model where positive emotions or negative emotions are experienced as interdependent negatively correlated opposites (e.g., see Lang et al. 1993; Ortony, Clore, & Collins 1988; Russell & Carroll 1999).

Below, we report the results of factor analysis and structural equation modeling, providing evidence that the multivariate Recalibrational Model significantly outperforms the Valence Model when describing the patterned experience of emotions reported after a Trust game. These results support the theory that sets of recalibrational emotions are triggered in patterned response to the adaptive problems produced by trust-based interactions.

1.1. Trust-Based Decision Dilemmas and Behavior Regulation by Short-Sighted and Long-Sighted Programs

When one is confronted with a dilemma, there is an internal conflict over how to pursue alternative desired outcomes that cannot be simultaneously fulfilled at their maxima. We study such a dilemma modeled by Berg, Dickhaut, and McCabe (1995), which we refer to as the Trust game. In the Trust game, an Investor first decides how much of a $10 endowment to send a paired Trustee, with the amount sent tripled, and then the Trustee decides how much of the tripled investment, or income, to return to the Investor.

The Trust game provides both short-sighted "opportunity" for gaining available resources and the possibility of developing a trust-based exchange relationship – a long-sighted security against the income risks associated with endowment asymmetry (such as resulting from the 50% chance of being Investor in this kind of experiment).[2] Short-sighted programs evolved to solve the adaptive problem of competition for limited resources with fleeting availability by

[2] While we study a single, anonymous interaction, our evolved psychology errs to caution by processing information about one-shot interactions under the premise that they may in fact be repeated in the future (e.g., see Delton et al. 2011). We also suspect that Investors who make trust-based choices discover consequent effects on their payoffs and extend this information in constructing generalizable models about the trustworthiness of Trustees in the population (e.g., the experimental subject pool).

encouraging capture of all resources present before they are depleted, foregone, or the possibility of seizing them becomes less certain or riskier. Reliable trust based exchange relationships are important securities that buffer against resource shortages and times of scarcity associated with risky income (e.g., from hunting, where 'lucky' individuals with food share with 'unlucky' individuals without food, with the expectation of reciprocity when roles are reversed). Indeed, laboratory studies have demonstrated that, in response to unsynchronized resource availability among individuals in a common environment, people act pre-disposed to engage in asynchronous trading relationships (Kaplan et al. 2012).

We propose that these adaptive problems, modeled by the Trust game, are regulated by short-sighted and long-sighted programs (e.g., see Carrillo 1998; Kurzban 2010) in conflict with one another (Livnat & Pippenger 2006). The relative calibrations of an individual's short- and long-sighted programs (determined by their unique histories, emotional capital, and present demands) regulate individuals' behavior propensity[3] in dilemmas such as the Trust game (see Figure 1). According to this dual program perspective, the Investor decision trades off his short-sighted "opportunistic" goal (achieved with earnings from a kept endowment and a maximally profitable investment) with his long-sighted "cooperative" goal (achieved by developing an exchange relationship in which both trust and trustworthiness are maximally demonstrated). Likewise, the Trustee, having received a trust-based multiplied transfer of funds from the Investor, must decide whether to pursue her short-sighted program's goal (by keeping this income), or else pursue her long-sighted program's goal of developing a trust-based exchange relationship by returning an amount equal to or greater than what the Investor originally sent and thereby demonstrating her trustworthiness.

1.2. Recalibrational Functions of Emotions and Prediction of Emotional Experience

Based on a review of the emotion literature (see Schniter & Shields 2013) and our own considerations, we conjectured emotions to have functional features and propose a classification system that categorizes the twenty emotional states studied (see Table 1) according to constellations of their shared functional features. We chose to classify and predict twenty emotional states because they are frequently used in versions of the one-dimensional Positive

[3] While we expect individual differences in *degree* (i.e., variance in relative strengths of regulatory programs or emotions), we do not expect differences in *kind* (i.e., direction of calibrational effects), since we take the existence of these programs to be species-typical adaptations.

and Negative Affect Scale (PANAS) developed by Watson et al. (1988), and predicted by the Valence Model that we compare to the multidimensional Recalibrational Model.

Nesse (2004, p.1138) states that, while emotions have been selected for because of their ability to solve specific adaptive problems, "...there is no one to one correspondence between an emotion and a function. One emotion can serve multiple functions, and one function may be served by several different emotions." Consistent with Nesse, our functional classification of twenty emotions yields five unique sets containing multiple emotions that we expect to be triggered in concert for common functional purposes (i.e., to facilitate achievement of short- and long-sighted program goals). We characterize these functions as *positive* and *negative* recalibrations, *intra* and *inter*personally targeting *short*- and *long*-sighted programs.

Generally, an adaptationist and functional perspective of emotions (e.g., Tooby & Cosmides 1990; Buck 1999; Cosmides & Tooby 2000) argues that emotions facilitate behavioral regulation by recruiting the assistance of a number of psychological, physiological, and behavioral processes that provide either positive or negative feedback (pleasant and unpleasant experience) used in updating the calibration of conflicting internal regulatory variables. Pleasant experiences are rewarding and can incentivize approach behavior and continuation of the prior behavior or interaction that triggered them (Watson et al. 1999; Carver & Scheier 1990). Unpleasant experiences are costly and motivate a change, whether through behavior reduction, avoidance, or aggression (Gray 1971). Of the set of twenty emotional states, we conjecture that nine [*appreciative, happy, content, cheerful, triumphant, inspired, secure, proud, believable*] are experienced as positive, one [*surprise*] could be either positive OR negative (forming the unique Set 3), and ten [*disgusted, jealous, aggravated, frustrated, angry, depressed, sad, embarrassed, ashamed, guilty*] are negative.

Emotions are ultimately designed to deal with adaptive problems requiring program orchestration (Tooby & Cosmides 1990, Cosmides & Tooby, 2000). The optimal calibration of programs managing an individual's behavior in a particular interaction depends in part on the calibration of other's behavior regulation programs. To solve this adaptive problem, emotions facilitate the achievement of program goals via intrapersonal and interpersonal behavior regulation (e.g., see Levenson 1999; Van Kleef et al. 2004; Butt, Choi, & Jaeger 2005). Below we discuss emotions with intrapersonal effects (reinforcing, maintaining, or changing one's own behavior), and interpersonal effects (reinforcing, maintaining, or changing another's behavior).

When one's prior actions did not succeed in achieving an adaptive goal, intrapersonal negative emotions are triggered to recalibrate one's own regulatory programs (Gómez-Miñambres & Schniter 2012). For example, guilt, an intrapersonal emotion triggered exclusively in response to a failure of the long-sighted program, recalibrates (i.e., downregulating) one's short-sighted program, decreasing the value of immediate opportunistic payoffs. As a result, valuation of the long-sighted goal increases, affecting the ability to "commit" to its pursuit (Frank 1988). On the other hand, when one's prior actions have succeeded in achieving an adaptive goal, positive emotions are triggered and recalibrate regulatory programs in the self to ensure further achievements. For example, the experience of feeling believable and proud occurs when positive emotions are triggered by the decision to engage in cooperative behavior. These positive intrapersonal emotions upregulate the long-sighted program (relative to the short-sighted program) so as to further encourage the behavior that led to successful cooperation. We conjecture that, of the twenty emotional states studied, seven [*triumphant, inspired, secure, proud, believable, surprised, guilty*] are exclusively intrapersonal.

Another way that emotions are designed to function is interpersonally: by regulating others' programs in an effort to affect interaction behaviors with one's self. For example, consider the gratitude emotion. Discovery that another has foregone short-term rewards in the pursuit of a long-term exchange relationship with one's self, for example by providing resource or assistance, presents a fortunate relationship building opportunity for the recipient. Gratitude and appreciation can signal one's favorable valuation of the other and propensity to cooperate with them (Tooby & Cosmides 2008), encouraging future trust much in the way that "promises" do (Schniter, Sheremeta, & Sznycer 2012). Experimental evidence supports this functional account of grateful and appreciative feelings (Tesser, Gatewood, & Driver 1968; Algoe, Haidt, & Gable 2008; McCullough et al. 2001).

We conjecture that most of the emotions studied (thirteen of twenty), function both intrapersonally and interpersonally. By initiating self-imposed recalibrations with the functional equivalence of recalibrations that the offended party might otherwise impose, shame and embarrassment downregulate the other's non-cooperative inclination so as to preempt targeted inter-personal recalibrations of one's self. For example, shame could preempt another's anger or disgust reaction if it preemptively led to self-punishment and distancing one's self from the other. Likewise, the appeasement function of embarrassment may act remedially; by effectively allowing rule violators to hedonically punish themselves, the angry and aggressive responses of offended parties are preempted (Keltner, Young, & Buswell 1997; de Jong 1999).

While we conjecture that fifteen of the twenty emotional states studied may facilitate the achievement of either short- or long-sighted progams' goals, we consider five emotional states to exclusively facilitate achievement of the long-sighted program's goal. Of these we derive two unique sets: a positive Set 2 [*proud, believable*] and a negative Set 5 [*embarrassed, ashamed, guilty*]. The positive emotional states that facilitate both short-sighted and long-sighted programs [*appreciative, happy, content, cheerful, triumphant, inspired, secure*] form the unique Set 1. The negative emotional states that facilitate both short-sighted and long-sighted programs [*disgusted, jealous, aggravated, frustrated, angry, depressed, sad*] form the unique Set 4. We next explain how, according to the recliabrational theory, emotions are triggered by computationally assessments of successes and failures in the Trust game.

Our recalibrational theory of emotions is built around conflicting short-sighted and long-sighted behavior regulation programs, which determine an individual's choices when faced with decision dilemmas, such as in the Trust game. We propose that the emotions facilitating achievement of these programs' goals computationally assess game outcomes for the purpose of identifying and reacting to successes and failures of the short-sighted and long-sighted programs (in self and other). According to our model, emotions are "triggered" when they integrate information about the Trust game outcome and computationally identify specific successes and failures. We label these computational triggers *L* and *S*, for the long-sighted program's goal achievement and the short-sighted program's goal achievement, respectively.

We define the following variables observed in our Trust game: endowment (= e), amount sent by Investor (= s), amount returned by Trustee (= r). We calculated success (with a maximum of 1 and minimum of 0) of the short-sighted program achieving its goal (*S*) according to competing perspectives of the Investor (I) and Trustee (T):

$S_I = (e - s + r)/(e + 2s)$

$S_T = (3s - r)/3s$ if $s > 0$, else 0.

We calculated success (with a maximum of 1 and minimum of 0) of the long-sighted program achieving its goal (*L*), based on the mutual perspective shared by Investor and Trustee:

$L_{I,T}$ = Trust * Trustworthiness,

where Trust = s/e, and Trustworthiness = $\min\{r/s, 1\}$ if $s > 0$, else 0.

S evaluates the short-sighted program's goal achievement after Investor and Trustee decisions have been made. In addition to valuing any portion of the endowment kept, an Investor's short-sighted program values maximally recouping profitable returns on any investment made. Thus, to reasonably evaluate opportunity captured by an Investor we consider how much of the endowment was kept and how much of the multiplied investment was recouped by calculating $(e – s + r)/(e + 2s)$. Accordingly, an Investor's *S* is maximized (= 1) when all endowment was kept (in which case $s = 0$ and $r = 0$), or if – in addition to any endowment kept – the maximum possible profitable return from the investment was recouped (i.e., $r = 3s$). A Trustee's *S* is maximized (= 1) when $s > 0$ and $r = 0$ and is minimized (= 0) when either $s = 0$ or when $s > 0$ and $r = 3s$.

The consummation of a cooperative trust-based relationship requires that both trust and trustworthiness be demonstrated. Trust is demonstrated by the invested amount of endowment at risk. Trustworthiness is demonstrated by proportion of investment voluntarily reciprocated to the Investor. A cooperative trust-based relationship fails to be established when either the Investor or the Trustee has pursued maximum opportunism. As such, $L = 0$ when $s = 0$ or when $r = 0$.

In summary, emotions are triggered by computational assessments of short- and long-sighted programs' successes and failures. Positive emotional states are maximally experienced when trigger values are largest (= 1) and negative emotional states are maximally experienced when trigger values are smallest (= 0). According to their design functions, triggered emotions either contribute to the reinforcement of successes or the reduction of failures by upregulating or downregulating specific programs in self and others. We tested whether constellations of specific antecedents (the *L* and *S* triggers produced by Trust game interaction) reliably predict specific sets of emotional experiences.

2. Design, Predictions and Procedures

2.1. Natural Experiment Design

We conducted a Trust game in which the Investor received an endowment of $10 and could send any portion of it to the Trustee, with the amount sent tripled. The Trustee then decided how much of the tripled investment, or income, to return (or else keep). Following the

Trust game we administered a 20-item emotional status survey[4] in which participants reported how much they felt each of 20 emotional states (on a five point scale labeled (1) very slightly or not at all, (2) a little, (3) moderately, (4) quite a bit, (5) extremely) as a consequence of their recent game interactions and outcomes. The computer software presented all emotional states on one screen and in random order. Using this laboratory implementation of the Trust game, which engaged participants in one-shot anonymous economic interactions, and a well-established emotional status survey, we investigated whether emotional experiences were reported in a patterned and predicted way as a consequence of game outcomes.

2.2. Predictions

Inspired by functional theories of social emotions (Trivers 1981; Cosmides & Tooby 1989), Nesse (1990, p.275; 1999, p.458) made various predictions about how specific emotions mediating reciprocity would be triggered by the four types of interaction patterns produced by a repeated Prisoner's Dilemma game. To our knowledge Nesse's predictions have not yet been tested. This paper takes a similar natural experiment approach and examines the relationship between participants' endogenous generation of Trust game outcomes and consequential reports of emotion. Like the Prisoner's Dilemma, the Trust game is another model for transactions require trust, albeit a model of asynchronous (rather than synchronous) trust-based exchange.

With the set of predictions below, generated by Valence Models and the Recalibrational Model, we tested assumptions and compared how well different models of emotional experience predict the emotions reported by participants who had just completed Trust games.

Valence Models

P1: In all three versions of the Valence Model, predicted in **P1.1-P1.3** below, emotions show positive correlation within the Positive Affect (PA) and Negative Affect (NA) set.

P1.1: PA & NA sets are *independent:* no correlation (= 0) is expected between them.

[4] To avoid experimenter demand effects that might result by soliciting reports on only a few select emotional states commonly ascribed to failed trust-based interactions (i.e., anger and guilt) and identified in the literature (e.g., Ketelaar & Au 2003), we constructed a survey of a large array of emotional states, based on the Positive and Negative Affect Scale (PANAS), a self-report measure of positive and negative affect states developed by Watson et al. (1988) that has been demonstrated across large non-clinical samples to be a reliable and valid measure of these states (Crawford & Henry 2004).

P1.2: PA & NA sets are strictly *interdependent* with negative (= -1) correlation between them. Consistent with a purely "bipolar" model of valence, reports of simultaneously experienced strong positive emotion and strong negative emotion are unexpected.

P1.3: Interdependence is *unrestricted* between emotions in the PA & NA sets. While negative correlation is expected between sets, positive correlation between items in PA & NA sets can also occur.

Recalibrational Model

P2: Conflicted minds produce mixed emotions: at times involving positive correlation between (simultaneously experienced) positive and negative emotions.

P3: Emotion experiences are reported in a patterned way according to a multivariate set of shared recalibrational features (i.e., *positive* and/or *negative* recalibration effects, targeting *short*- and/or *long*-sighted programs, *intra* and/or *inter*personally).

P4: *L* and *S* (variables evaluating outcomes from Trust game interactions) predict the patterned experience of emotions for the 4 testable sets of the Recalibration model better than for the 2 sets of the Valence models.

2.3. Experimental Procedures

The experiment, programmed using z-Tree (Fischbacher 2007), was conducted at Chapman University's Economic Science Institute. Participants were recruited from a campus-wide subject pool consisting primarily of undergraduate students.

There were eight experimental sessions, each lasting approximately thirty-five minutes. No participant participated more than once. Each session had between 18 and 24 participants, seated in individual cubicles, and was conducted as follows. An experimenter read the instructions aloud explaining experimental procedures and payoffs while every participant followed along with their own copy of the instructions. After finishing the instructions, participants were given five minutes to privately write down their answers to several quiz questions. After participants completed the quiz, the experimenter distributed a printed copy of the correct quiz answers. To ensure understanding, any remaining questions were answered privately.

Participants, randomly assigned to one of two roles: "person 1" (Investor) or "person 2" (Trustee), interacted anonymously in the Trust game over a local computer network, then completed the 20 item survey in which they reported the intensity of various emotional states consequent on their decisions, game interactions, and resulting outcomes. Earnings from the Trust game plus $7 for arriving to the experiment on time and participating were paid out privately at the end of the experiment.

3. Results

In this section, we report general results of the Trust game and the emotional status survey. In section 3.1 we investigate whether 20 emotions were experienced in a patterned way that conforms to predictions of the Recalibrational Model or predictions of Valence Models. In section 3.2 we examine the full models of emotional experiences according to four triggers (based on computation of adaptive problems consequent of economic decisions and interactions), comparing the fit of the unrestricted Valence Model and the Recalibrational Model.

We found no significant differences between the eight sessions and report the joint results of all 170 participants. Figure 2 displays the scatter plot of the amount sent and the amount returned. There was substantial variability in individual behavior. On average, Investors sent $6.01 (SD = 3.64) and Trustees returned $6.16 (SD = 5.92), resulting in profits of $10.14 (SD = 3.72) and $11.88 (SD = 7.12), respectively. These results are consistent with previous findings of Berg et al. (1995). Likewise, there was substantial variability in individual reports of emotional experience. The average reported emotional state (as a result of Trust game interactions) had a mean of 2.20 (median = 1, SD = 1.45), near 2 ("a little"). Ratings on every emotional state ranged from 1 ("very slightly or not at all") to 5 ("extremely"). While the modal report for most (17/20) emotional states was 1 ("very slightly or not at all") modes were also seen at 3 for *happy* and 5 for *content* and *appreciative*. Reports of 1 were more frequent for emotional states in the negative set than for the positive set (1218/1700 versus 527/1700, respectively), contributing to significantly lower intensity of reported negative states (M = 1.61, SD = .77) than positive states (M = 2.80, SD = 1.08) according to Wilcoxon matched-pairs tests (Z = 7.605, $p < .001$). This pattern of significantly lower reported negative states was observed in both Investors (Z = 5.853, $p < .001$) and Trustees (Z = 4.888, $p < .001$).

3.1 Shared Features of Emotions

Valence Models assume two factors: one comprised of a standard set of positive emotional states that positively correlate with one another [*appreciative, happy, content,* *cheerful, triumphant, inspired, secure, proud, believable, and surprised*], and the other comprised of a standard set of negative emotional states that positively correlate with one another [*disgusted, jealous, aggravated, frustrated, angry, depressed, sad, embarrassed, ashamed, and guilty*] [5]. Using exploratory factor analysis, we rejected that a two-factor model fit the data best, as the Bayesian information criterion (BIC) was inferior to models with three, four, five, six, seven, and eight factors[6]. Consistent with **P1**, item analysis indicated that not all (43 of 45) correlations were significantly positive between positive states nor between all (36 of 45) negative states.

Consistent with **P1.3** and **P2**, cross tabulation indicated occurrences of simultaneously experienced positive and negative emotional states. Among all reported emotional states, we observed 57 cases from 13 (7.64% of) respondents reporting positive and negative states that were both felt "extremely" (= 5); 231 cases from 34 (20% of) respondents reporting positive and negative states that were both felt in the range from "quite a bit" to "extremely" (≥ 4); 973 cases from 69 (40.59% of) respondents reporting positive and negative states that were both felt in the range from "moderately" to "extremely" (≥ 3); and 2653 cases from 114 (67.06%) respondents reporting positive and negative states that were both felt in the range from "a little" to "extremely" (≥ 2).

We used Confirmatory Factor Analysis (CFA)[7] to measure how well our data on reported emotional states fit the Recalibrational Model and variants of the Valence Models. Each variant of the Valence Model shares the assumption that positive correlations exist among individuals' reported positive states and positive correlations exist among individuals' reported negative states. Therefore, in all Valence Models we constrained each emotion to load onto only one of the two factors. However, because each variant of the Valence Model has a *different* assumption concerning relationships that might exist among simultaneously experienced of positive and negative states, they differ only in the constraints they impose on the positive and negative factor correlations. Model 1 constrains the factors to have a zero correlation (where positive states bear

---

[5] These "standard" sets were based on the PANAS (e.g., Watson et al. 1988).
[6] Results are available upon request.
[7] We used Stata version 12.1 and the 'SEM' procedure (Structural Equations Model) finding the fit for maximum likelihood. One participant was dropped who reported the same value for all emotional states. Additionally, we omitted surprise from both the Recalibrational Model's and Valence models' fit tests because, being the only emotional state included in the Recalibrational Model Set 3, it would have produced an automatic significant loading within the Recalibrational Model, unfairly biasing results in its favor.

no relationship with negative states), Model 2 constrains the factors to a correlation of negative one (as would be appropriate if the experience of emotional states was only possible on a bipolar continuum), and Model 3 imposes no restrictions on the factors' correlation.

Summaries of factor analysis results for the three Valence models and the Recalibrational model are shown in Table 2. The lesser Bayesian information criterion (BIC), lesser root mean square error of approximation (RMSEA), greater comparative fit index (CFI), and greater log-likelihood (LL) made it apparent that Model 1 fit better than Model 2, and that Model 3 fit better than Model 1. The difference between Model 3 and Model 1 was statistically significant ($X^2(1) = 48.01$, $p < .001$). Consistent with **P1.3**, Model 3's correlation between positive and negative factors was -.70 and significantly different from zero and from -1 ($p < .001$, 95% CI [-.787, -.614]).

We used CFA to evaluate the fit of nineteen emotions in their functional sets derived from the Recalibrational Model. In Table 2 we describe this derived fit as "Model R". Model R predicted the patterned experience of emotions according to the four factors corresponding to Set 1, Set 2, Set 4, and Set 5 of the Recalibrational Model (see Table 1). Consistent with **P3**, all emotional states loaded positively and significantly (at a 1% level) onto the predicted latent factors of Model R, but not the predicted latent factors of Valance Model 3.[8] With a greater LL, greater CFI, lesser RMSEA and lesser BIC, Model R provided a better fit than the unrestricted Valence Model 3 (according to guidelines set forth by Gefen et al. (2011)).

3.2. Comparison of Structural Equation Model Fit

We used Structural Equation modeling to compare the fit of the Recalibrational Model to the fit of the Unrestricted Valence Model. To compare these models we tested both with triggers *S* and *L*, as computed from game interactions. Results of both exercises are shown in Table 3. Given that we did not find support for either perfect independence or interdependence in section 3.1, we did not restrict correlations and allowed all latent factors to freely correlate in both models.[9] The Recalibrational Model has more factors than the Valence Model which could arguable lead to "overfitting" – having a better fit by describing more error instead of predicted

[8] Results available upon request.
[9] Comparative measures penalized for additional variables. Given that all between factor correlations were significant for the unrestricted Valence Model but not for the Recalibrational Model, this choice should bias against the Recalibrational Model's relative fit superiority.

relationship. To avoid overfitting, we report the BIC, which penalizes for added variables. Finally, we report the difference between models, assessing whether the better fit was statistically significant despite the difference in factors seen in Table 3.

As with CFA, we found superior results for the Recalibrational Model, consistent with **P4**. Despite penalizing for additional fitted variables, the difference was significant. In the Recalibration Model, all of the latent DV triggers' coefficients were significant (below 5%) with the predicted sign (see Table 4), whereas in the Unrestricted Valence Model not all (17 of 19) of the trigger's coefficients were significant (see Table 4). Finally, we found the overall equation level goodness of fit higher for the Recalibration Model.

4. Discussion

Using confirmatory factor analysis to assess latent sets, and structural equation models to assess triggers on latent sets we demonstrated that the Recalibrational Model predicts the experience of predicted emotional states (specifically, five latent sets of these) following the Trust game, strongly and significantly outperforming the Valence Models. While neither model has very good "approximate model fit" according to guidelines proposed by Hu and Bentler (1999), we caution readers that there is substantial disagreement in the literature about interpreting such guidelines (Marsh, Hau, & Wen 2004; Beauducel & Wittmann 2005; Fan & Sivo 2005; Yuan 2005; Tomarken & Waller 2005; Barrett 2007). The important take-away from results of our model comparisons is that we provide an improvement over the widely accepted Valence Models used in predicting emotional reports. In addition to better fit, our Recalibrational Model is interpretable because it is derived from principles of "recalibrational theory". Below we discuss potential sources of unexplained variance, consider future directions for further exploring the predicted effects of recalibrational emotions on trust-based interactions, and suggest some implications of having conflicted minds for both scientific and well-being pursuits.

We consider two potential classes of explanations for currently unexplained variation in how strongly emotional experiences are rated by participants: first, that participants either have imperfect access to their emotional states, differing interpretations of the emotion labels, or the fidelity of their reports is compromised, and second, that there is heterogeneity in the experience of certain emotions (e.g., guilt).

People who are asked to rate single emotions may not be able to accurately describe their emotional states (Ellsworth & Tong 2006) if emotion experiences are more often and accurately described with multiple words (Izard 1977), or with different words among different people. While we acknowledge that language could present problems for this research, the success of previous research on self-reported emotions in conjunction with experimental games (Ketelaar & Au 2003) gave us encouragement in pursuing measures of self-reported emotions following an economic game. Nevertheless, analysis of emotion reports revealed a “floor effect” that might have resulted from a problem with the instrument used, untruthful results, pathological inactivation of emotions in the studied context, a problem interpreting emotion labels, and difficulty identifying and reporting emotional states.

Nemanick and Munz (1994) suggested that the PANAS scale’s lower anchor may not be properly constructed to form a true lower pole. The PANAS response option “1”, the lowest response possible on the five point Likert, is labeled with a combination of two state levels: “not at all” and “very slightly”. By combining both state levels into a single response option a larger proportion of response types from the possible spectrum (not at all to always) may accumulate at that value. Future research should consider restructuring the response options and testing whether a different distribution of responses results.

Data quality may also have been affected if participants made untruthful reports. Experimental economists are particularly concerned that participants “will not ‘tell the truth’ unless incentives make truth telling compatible with maximizing utility” (Lopes 1994, p.218). According to a meta-review by Camerer and Hogarth (1999) there is no clear evidence that additional financial incentives would improve the quality of responses in a simple survey task like ours. In fact, it has been noted that for short tasks like PANAS surveys that people are known to voluntarily complete without problem (because they have sufficient intrinsic motivation to do so), an attempt at increasing participation via financial incentives often “backfires” with counter-intentional effects (e.g., see Mellstrom & Johannesson 2008). Nevertheless, wary of the possibility that participants may have been incentivized to use efficiency tactics to expediently complete the survey (such as marking all responses with the same), we reviewed our data and found only one apparent case[10] of such behavior (< 1% of sample).

[10] This individual reported 3s on all emotions.

Frequency dependent selection can produce relatively stable mixed types in a population (e.g., see Lomborg 1996), a phenomenon that might contribute to individual variation in emotional reports (Ketelaar 2004; Mealey 1995). For example, sociopaths who comprise about 5% of the adult population (Mealey 1995) do not respond to remedial social gestures and likely lack emotions like guilt that facilitate the long-sighted program (e.g., see King-Cases et al. 2008). We are unable to account for individual variation in types that exist in our sample.

A battery of 20 emotional states (like in the PANAS) may be too broad for the purpose of studies like ours. Self-access to some of the emotional states studied may be limited and interpretation of labels may not be uniform. We chose this battery because it is comparable among widely used measures of multiple emotional states, however future studies on trust and emotions would benefit from a select set more appropriate to the problems studied. In selecting a refined set, universally interpretable and recognizable emotional states should be considered. We suggest appreciative, happy, proud, frustrated, angry, and guilty: a selected set with balanced valance that is representative of the functional categories covered by our model. Additionally, we observed that the emotional states represented in this selected set were individually predicted well (see Table 4) and demonstrated less of a floor effect than the other emotional states we studied (total 1s reported were 479/1020 or 47% versus 1266/2380 or 53.2%, respectively).

By triangulating with more objective neurological, physiological, and behavioral measures of emotional states some of the discussed limitations of itemized self-reports could be overcome. While untruthful reporting and reports by abnormal types in the population may occur and should be of consider by future research, we do not expect that these factors account for a large portion of observed variance.

While we have developed theory of emotions' ultimate function (i.e., what the mechanisms were selected to do) and derived our predictions of antecedents from it, this study only tests the emotions' proximate functioning (i.e., how and when the mechanisms are triggered). Future studies can take the Recalibrational Model one step further and test for ultimate functions by examining whether the future actions of those individuals who report emotions under the predicted conditions are affected as theory predicts. Three studies which we know of have taken this approach to testing ultimate functions already: Ketelaar and Au (2003) who demonstrated how the experience of guilt leads to choices of cooperation over opportunism, Fehr and Gachter (2002) who demonstrated that angry individuals are more likely to engage in costly punishment, and Dunn and Schweitzer (2005) who have shown that Investor happiness and gratitude increase trust in the Trust game.

The experience of mixed emotions has been discussed by others (Cacioppo, Gardner, & Berntson 1999) and evoked with wins and losses in the laboratory (Larsen, McGraw, & Cacioppo 2001; Larsen et al. 2004), as well as by trust-based interaction in our study. However, mixed emotions are not well appreciated as a core trait of human nature, and may appear as flaws of human nature that interfere with rationality (Sherer 1984; Elster 1995). While some researchers have long moved past the bipolar affect models, instead recognizing that positive and negative affect are at times independent dimensions (e.g., see Watson, Clark, & Tellegen 1988), psychophysiologists (Driscoll, Tranel, & Anderson 2009; Lang, Greenwald, Bradley, & Hamm 1993) neuroscientists (Proverbio, Zani, & Adorni 2008; Screenivas, Boehm, & Linden 2012) behavioral economists (Morretti & di Pellegrino 2010; Brandts, Riedl, & van Winden 2009; Van den Berg, Dewitte, & Warlop 2008; Morris 1995) and decision scientists (Hogarth, Portell, Cuxart, & Kolev 2011; Reid & Gonzalez-Vallejo 2009; Schlosser, Dunning, & Fetchenhauer 2013) continue to use bipolar affect scales (for example, the Self-Assessment-Manikin valence scale developed by Lang (1980)). Our study cautions against assuming that the explanatory power provided by the Valence Model is sufficient for understanding relationships between trust-based behavior and emotions. We suggest that more complex multivariate models, such as the Recalibrational Model, better track the triggered experience of mixed emotions and subsequent behaviors.

In light of our model, we have identified the mechanics that could produce an emotional equilibrium between partners: a condition in which the emotional impact of partners' behavior on each other and on themselves is one in which all engaged programs are kept in the same relative state (before and after action). An important implication of this stable equilibrium is that even under such conditions, the mind is expected to remain conflicted. The recognition of a conflicted mind and the experience of mixed emotions challenges our intuitions of a "self's" singular internal interests and the consonance of a non-contradictory self-representation generally attributed to a sane mind. While the implications of a modular recalibrational theory of emotions might be existentially and even epistemologically difficult to grapple with, we extend the following practical implications for mental health professionals and laypeople alike.

Psychotherapists often treat patients who complain of and suffer from emotional states – and it is not uncommon for patients that patronize these professionals to seek an escape from unwelcomed emotions (e.g., Nesse 1991, 2000). Treatment of these emotions, whether through behavioral intervention or psycho-pharmaceutical treatment, may benefit from the degree to which psychologists, psychiatrists, and counselors are informed of (1) the functional uniqueness and similarities distinguishing the emotions and their taxonomic classifications, and (2) the choice dilemmas and post-decision situations from which emotional states precipitate. The Recalibrational Model suggests that it is unrealistic and potentially harmful for wellbeing pursuits to aspire for a purely "positive" emotional state via complete transcendence or removal of "negative" emotional states. Life entails suffering and happiness because both positive and negative emotional states serve needed functions, recalibrating our own inner-workings as well as the inner-workings of those that we interact with. Given the uncertain future, we need to constantly engage in recalibration of ourselves and others to make the most of opportunities given our needs.

References

Algoe, S., & Haidt, J., & Gable, S. (2008). Beyond reciprocity: Gratitude and relationships in everyday life. *Emotion*, 8, 425-429.

Barrett, P. (2007). Structural equation modelling: Adjudging model fit. *Personality and Individual Differences*, 42(5), 815-824.

Berg, J., Dickhaut, J., & McCabe, K. (1995). Trust, reciprocity, and social history. *Games and Economic Behavior*, 10, 122–142.

Beauducel, A., & Wittmann, W. (2005). Simulation study on fit indices in confirmatory factor analysis based on data with slightly distorted simple structure. *Structural Equation Modeling*, 12(1), 41-75.

Brandts, J., Riedl, A., & van Winden, F. (2009): Competitive rivalry, social disposition, and subjective well-being: an experiment. *Journal of Public Economics*, 93(11-12), 1158-1167.

Buck, R. (1999). The Biological affects: A typology. *Psychological Review,* 106, 301-336.

Butt, A.N., Choi, J.N., & Jaeger, A.M (2005). The effects of self-emotion, counterpart emotion, and counterpart behavior on negotiator behavior: a comparison of individual level and dyad level dynamics. *Journal of Organizational Behavior*, 26(6), 681-704

Cacioppo, J.T., Gardner, W.L., & Berntson, G.G. (1999). The affect system has parallel and integrative processing components: Form follows function. *Journal of Personality and Social Psychology*, 76, 839-855.

Camerer, C., & Hogarth, R. (1999). The effects of financial incentives in experiments: a review and capital-labor production framework. *Journal of Risk and Uncertainty*, 19, 7-42

Carrillo, J.D. (1998). *Self-control, moderate consumption, and craving*. DEPR D.P. 2017, London.

Carver, C.S., & Scheier, M.F. (1990). Origins and functions of positive and negative affect: a control-process view. *Psychological Review,* 97, 19-35.

Cosmides, L., & Tooby, J. (2000). Evolutionary psychology and the emotions In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of Emotions, 2nd Edition.* (pp. 91-115.) NY: Guilford.

Cosmides, L., & Tooby, J. (1989). Evolutionary psychology and the generation of culture, part ii. case study: A computational theory of social exchange. *Ethology and Sociobiology*, 10(1-3), 51–97.

Crawford, J.R., & Henry, J.D. (2004). The Positive and Negative Affect Schedule (PANAS): construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology*, 43, 245-265.

de Jong, P.J. (1999). Communicative and remedial effects of social blushing. *Journal of Nonverbal Behavior*, 23(3), 197-217.

Delton, A.W., Krasnow, M. M., Tooby, J., & Cosmides, L. (2011). The Evolution of direct reciprocity under uncertainty can explain human generosity in one-shot encounters. *Proceedings of the National Academy of Science*, 108(32), 13335-13340.

Driscoll, D., Tranel, D., & Anderson, S.W. (2009). The effects of voluntary regulation of positive and negative emotion on psychophysiological responsiveness. *International Journal of Psychophysiology*, 72(1), 61-66.

Dunn, J., & Schweitzer, M. (2005). Feeling and believing: The influence of emotion on trust. *Journal of Personality and Social Psychology*, 88, 736-748.

Ellsworth, P.C., & Tong, M.W. (2006). What does it mean to be angry at yourself? Categories, appraisals, and the problem of language. *Emotion*, 6(4), 572-586.

Elster, J. (1995). Rationality and the emotions. *Economic Journal,* 116, 1386-1397.

Fan, X., & Sivo, S. A. (2005). Sensitivity of fit indices to misspecified structural or measurement model components: rationale of two-index strategy revisited. *Structural Equation Modeling*, 12(3), 343–367.

Fehr, E., & Gächter, S. (2002). Altruistic punishment in humans. *Nature*, 415, 137-140.

Fischbacher, U. (2007). z-Tree: Zurich toolbox for ready-made economic experiments. *Experimental Economics*, 10(2), 171-178.

Frank, R.L. (1988). *Passions Within Reason: the Strategic Role of the Emotions.* NY: Norton.

Gefen, D., Rigdon, E., & Straub, D.W. (2011). An Update and Extension to SEM Guidelines for Administrative and Social Science Research. *MIS Quarterly 35*(2), III-XIV.

Gómez-Miñambres, J., & Schniter, E. (2012). Menu-Dependent Emotions and Self-Control. Available at SSRN: http://ssrn.com/abstract=2152036

Gray, J.A. (1971). *The Psychology of Fear and Stress*. New York: McGraw-Hill

Hare, T.A., Camerer, C.F., & Rangel. A. (2009). Self-Control in Decision Making Involves Modulation of the vmPFC Valuation System. *Science*, 324, 646-648.

Hogarth, R.M., Portell, M., Cuxart, A., & Kolev, G.I. (2011). Emotion and reason in everyday risk perception. *Journal of Behavioral Decision Making*, 24(2), 202-222.

Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, 6(1), 1-55.

Izard, C.E. (1977). *Human Emotions*. New York: Plenum.

Kaplan, H., Schniter, E., Smith, V., & Wilson, B. (2012). Risk and the evolution of human exchange. *Proceedings of the Royal Society: Biological Sciences*, 279(1740), 2930-2935.

Keltner, D., Young, R.C., & Buswell, B.N. (1997). Appeasement in human emotion, social practice, and personality. *Aggressive Behavior*, 23, 359-374.

Ketelaar, T., & Au, W.T. (2003). The effects of guilty feelings on the behavior of uncooperative individuals in repeated social bargaining games: An Affect-as-information interpretation of the role of emotion in social interaction. *Cognition & Emotion*, 17, 429-453.

Ketelaar, T. (2004). Ancestral Emotions, Current Decisions: Using Evolutionary Game Theory to explore the role of Emotions in decision-making. Crawford, C. & Salmon, C. (Eds). *Darwinism, Public Policy and Private Decisions* (pp 145-168). Lawrence Erlbaum Associates.

King-Cases, B., Sharp, C., Lomax-Bream, L., Lohrenz, T., Fonagy, P., & Montague, P.R. (2008). The rupture and repair of cooperation in borderline personality disorder. *Science*, 321, 806-810.

Kolenikov, S. (2009). Confirmatory factor analysis using confa. *Stata Journal*, 9(3), 329-373.

Kurzban, R. (2010). *Why Everyone (Else) Is a Hypocrite: Evolution and the Modular Mind.* Princeton, NJ: Princeton University Press.

Lang, P.J. (1980). Behavioral treatment and bio-behavioral assessment: computer applications. In J.B. Sidowski, J.H. Johnson, & T.A. Williams (Eds.), *Technology in mental health care delivery systems* (pp. 119-l37). Norwood, NJ: Ablex.

Lang, P.J., Greenwald, M.K., Bradley, M.M, & Hamm, A.O. (1993). Looking at pictures: Affective, facial, visceral, and behavioral reactions. *Psychophysiology*, 30, 261-273.

Larsen, J.T., McGraw, A.P., & Cacioppo, J.T. (2001). Can people feel happy and sad at the same time? *Journal of Personality and Social Psychology*, 81, 684-696.

Larsen, J.T., McGraw, A.P., Mellers, B.A., & Cacioppo, J.T. (2004). The agony of victory and thrill of defeat. *Psychological Science*, 15(5), 325-330.

Lerner, J. S., & Keltner, D. (2000). Beyond valence: Toward a model of emotion-specific influences on judgment and choice. *Cognition and Emotion*, 14, 473-493.

Lerner, J.S., & Keltner, D. (2001). Fear, anger, and risk. *Journal of Personality and Social Psychology*, 81, 146-159.

Levenson, R.W. (1999). The Intrapersonal functions of emotion. *Cognition and Emotion*, 13(5), 481-504.

Livnat, A., & Pippenger, N. (2006). An optimal brain can be composed of conflicting agents. *Proceedings of the National Academy of Sciences*, 103(9), 3198-3202.

Lomborg, B. (1996). Nucleus and shield: The evolution of social structure in the iterated Prisoner’s Dilemma. *American Sociological Review*, 61, 278-307.

Lopes, L.L. (1994). Psychology and economics: perspective on risk, cooperation, the marketplace. *Annual Review of Psychology*, 45, 197-227.

Marsh, H. W., Hau, K. T., & Wen, Z. (2004). In search of golden rules: Comment on hypothesis-testing approaches to setting cutoff values for fit indexes and dangers in overgeneralizing Hu and Bentler's (1999) findings. *Structural Equation Modeling*, 11(3), 320-341.

McClure, S.M., Laibson, D., Loewenstein, G., & Cohen, J.D. (2004). Separate Neural Systems Value Immediate and Delayed Monetary Rewards. *Science*, 306, 503-507.

McCullough, M.E., Kilpatrick, S.D., Emmons, R.A., & Larson, D.B. (2001). Is gratitude a moral affect? *Psychological Bulletin*, 127, 249-266.

Mealey, L. (1995). The sociobiology of sociopathy: An integrated evolutionary model. *Behavioral and Brain Sciences*, 18, 523-599.

Mellstrom, C., & Johannesson, M. (2008). Crowding out in blood donation: was Titmuss right? *Journal of the European Economic Association*, 6(4), 845-863.

Moretti, L., & di Pellegrino, G. (2010). Disgust selectively modulates reciprocal fairness in economic interactions. *Emotion*, 10(2), 169-180.

Morris, J.D. (1995). Observations: SAM: The Self-Assessment Manikin - An Efficient Cross-cultural Measurement of Emotional Response. *Journal of Advertising Research*, 35(6), 63-68.

Nesse, R.M. (1990). Evolutionary explanations of emotions. *Human Nature*, 1(3), 261-289.

Nesse, R.M. (1991). What good is feeling bad? The evolutionary benefits of psychic pain. *The Sciences*, November/December, 30-37.

Nesse, R.M. (1999). What Darwinian medicine offers psychiatry. In W. R. Trevathan, J. J. McKenna and E. O. Smith. (eds.) Evolutionary Medicine, New York: Oxford University Press.

Nesse, R.M. (2000). Is Depression an Adaptation? *Archives of General Psychiatry*, 57, 14-20.

Nesse, R.M. (2004). Natural selection and the elusiveness of happiness. *Philosophical Transactions of the Royal Society of London B*, 359, 1333-1347.

Ortony, A., & Turner, T. J. (1990). What’s basic about basic emotions? *Psychological Review*, 97, 315–331.

Ortony, A., Clore, G.L. & Collins, A. (1988). *The Cognitive Structure of Emotions*. Cambridge, NY: Cambridge University Press.

Proverbio, A.M., Zani, A., & Adorni, R. (2008). Neural markers of a greater female responsiveness to social stimuli. *BMC Neuroscience*, 9, 56.

Reid, A.A., & Gonzalez-Vallejo, C. (2009). Emotion as a tradeable quantity. *Journal of Behavioral Decision Making*, 22, 62-90.

Russell, J.A., & Carroll, J.M. (1999). On the bipolarity of positive and negative affect. *Psychological Bulletin*, 125(1), 3-30.

Scherer, K.R. (1984). On the nature and function of emotion: A component process approach. *in* K.R. Scherer and P. Ekman (eds.) *Approached to Emotion*. Hillsdale, NJ: Lawrence Erlbaum.

Schlosser, T., Dunning, D., & Fetchenhauer, D. (2013). What a feeling: the role of immediate and anticipated emotions in risky decisions. *Journal of Behavioral Decision Making*, 26(1), 13-30.

Schniter, E., Sheremeta, R.M., & Sznycer,D. (2012). Building and rebuilding trust with promises and apologies. *Journal of Economic Behavior & Organization*, forthcoming.

Schniter, E., Shields, T. (2013). Recalibrational emotions and the regulation of trust-based behaviors. In *Psychology of Trust: New Research*, D. Gefen (ed.) New York: Nova Science Publishers.

Screenivas, S., Boehm, S.G., & Linden, D.E.J. (2012). Emotional Faces and the default mode network. *Neuroscience Letters*, 506(2), 229-234.

Tellegen, A., Watson, D., & Clark, L.A. (1999). On the dimensional and hierarchical structure of affect. *Psychological Science*, 10, 297-303.

Tesser, A., Gatewood, G., & Driver, M. (1968). Some determinants of gratitude. *Journal of Personality and Social Psychology*. 9, 233-236.

Tomarken, A.J., & Waller, N.G. (2005). Structural equation modeling: Strengths, limitations, and misconceptions. *Annual Review of Clinical Psychology*, 1, 31-65.

Tooby, J., & Cosmides, L. (1990). The past explains the present: Emotional adaptations and the structure of ancestral environments. *Ethology and Sociobiology*, 11, 375-424.

Tooby, J., & Cosmides, L. (1992). The Psychological Foundations of Culture. In J. H. Barkow, L. Cosmides, & J. Tooby (Eds.), *The adapted mind: Evolutionary psychology and the generation of culture* (pp. 19 .36). Oxford, England: Oxford University Press.

Tooby, J., & Cosmides, L. (2008). The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In M. Lewis, J.M. Haviland-Jones & L.F. Barrett (Eds.), *Handbook of Emotions*, 3rd Ed. (pp. 114-137.) NY: Guilford.

Trivers, R.L. (1981). Sociobiology and Politics. In *Sociobiology and Politics*, E. White, ed. pp. 1-43. Lexington: Lexington Books.

Van den Berg, B., Dewitte, S., & Warlop, L. (2008). Bikinis instigate generalized impatience in intertemporal choice. *Journal of Consumer Research*, 35(1), 85-97.

Van Kleef, G.A., de Dreu, C.W.W., & Manstead, A.S.R. (2004). The interpersonal effects of emotion in negotiations: A motivated information processing approach. *Journal of Personality and Social Psychology*, 87, 510-528.

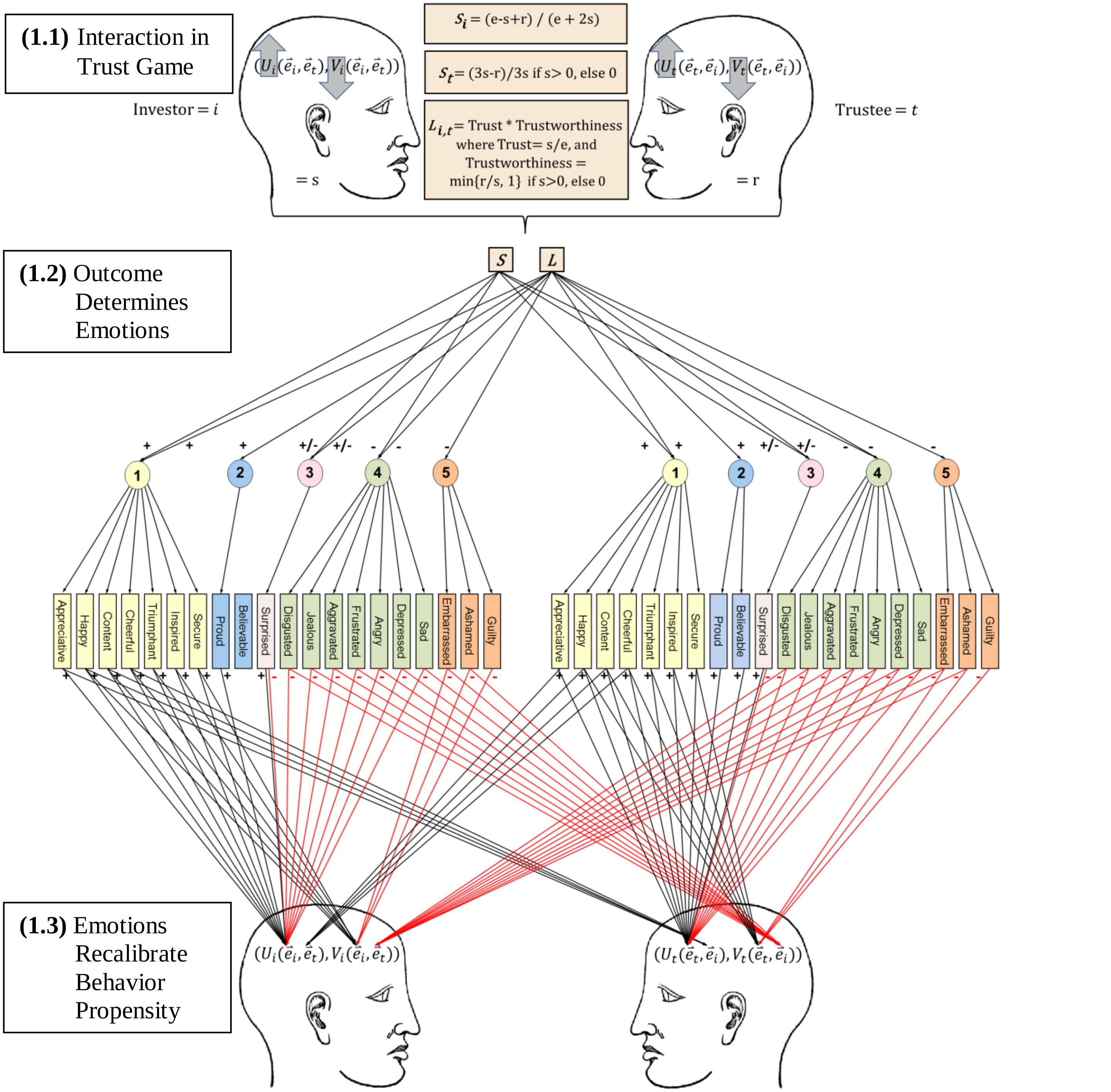
von Neumann, J., & Morgenstern, O. (1944). *The Theory of Games and Economic Behavior*. Princeton, N.J.: Princeton, University Press.

Watson, D., Clark, L.A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063-1070.

Watson, D., Wiese, D., Vaidya, J., & Tellegen, A. (1999). The two general activation systems of affect: structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology*, 76, 820-838.

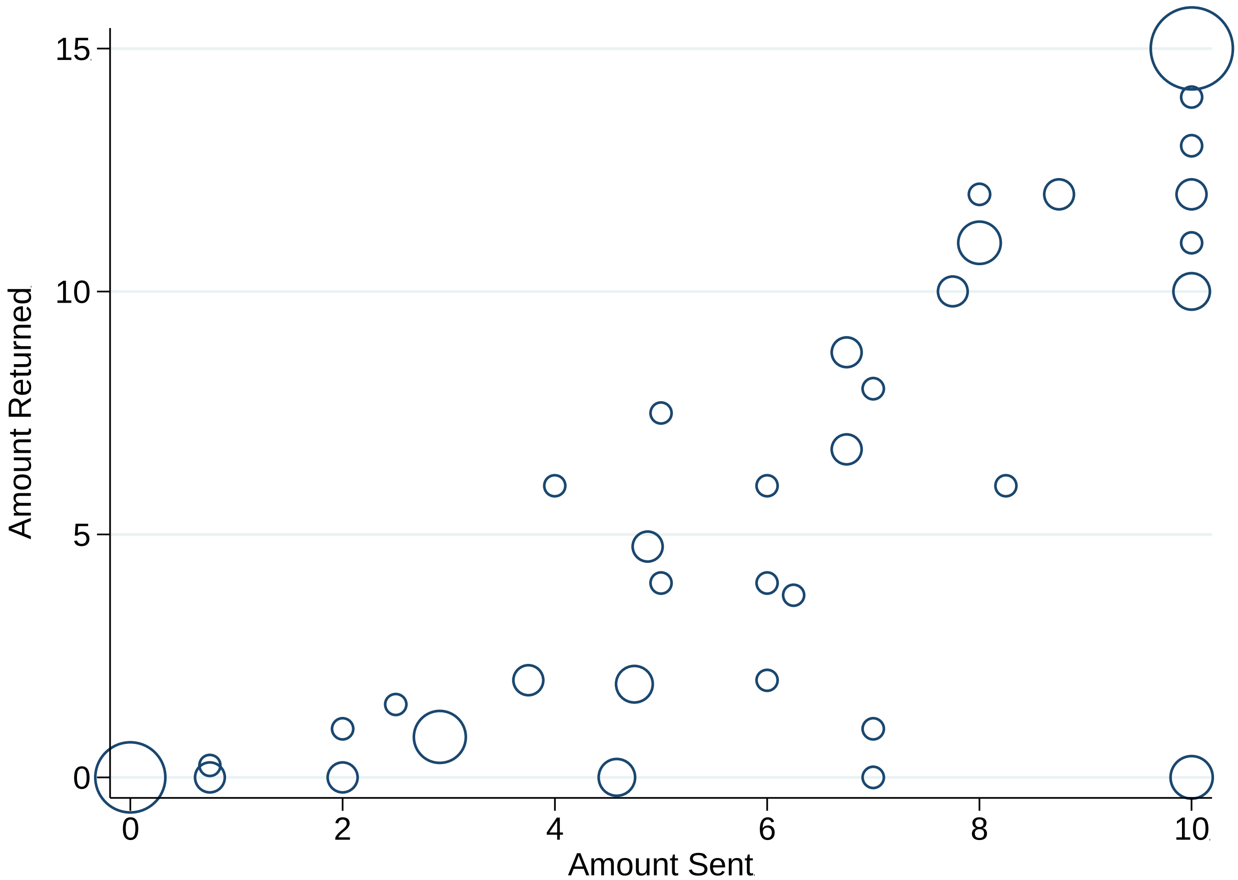
Yuan, K.H. (2005). Fit indices versus test statistics. *Multivariate Behavioral Research*, 40(1), 115–148.

Figure 1. Complete Recalibrational Model



Note: **(1.1)** Investor (i) and Trustee (t) each have two weights U and V, where $U \geq 0$ and $V \geq 0$, determining the relative power of conflicting long-sighted and short-sighted programs, respectively. The balance of weights determines behavior propensity via decision function, where U weakly increases and V weakly decreases amount sent (= s) or amount returned (= r), for the Investor (i) and Trustee (t), respectively. **(1.2)** Emotions compute trigger values S and L resulting from game outcomes. Positive emotional states are maximally experienced when their trigger values are largest (= 1) and negative emotional states are maximally experienced when their trigger values are smallest (= 0). **(1.3)** The weights are up- and down-regulated by arrays of positive and negative emotions (e_i, e_t) produced by self and other. Thus the weights are dynamically updated after being targeted by recalibrational emotions.

Figure 2. Bubble Plot of the Amount Sent and the Amount Returned.



Note: Observations were plotted with bubbles, where the relative size indicates the number of observations. The smallest bubble plotted represents one observation and the largest bubble plotted represents eight observations.

Table 1: Specific Classifying Features of Emotional States with Intrapersonal and Interpersonal Targets

Set	Emotional State	Functional Features					
		Facilitating Adaptive Goal(s)		Recalibrational Effect		Recalibrational Target	
		U: Long-sighted	*V: Short-sighted*	Positive	Negative	Intrapersonal	Interpersonal
1	***Appreciative***	X	X	X		U	U
	Happy	X	X	X		U,V	U
	Content	X	X	X		U,V	U
	Cheerful	X	X	X		U,V	U
	Triumphant	X	X	X		U,V	
	Inspired	X	X	X		U,V	
	Secure	X	X	X		U,V	
2	***Proud***	X		X		U	
	Believable	X		X		U†	
3	***Surprised***	X	X	X	X	U‡	
4	***Disgusted***	X	X		X	U	V
	Jealous	X	X		X	U	V
	Aggravated	X	X		X	U	V
	Frustrated	X	X		X	U	V
	Angry	X	X		X	U	V
	Depressed	X	X		X	U	V
	Sad	X	X		X	U	V
5	***Embarrassed***	X			X	V	V
	Ashamed	X			X	V	V
	Guilty	X			X	V	

Note: X's indicate classifying features of emotional states. Cells populated under "Intrapersonal" and "Interpersonal" specify the targets (U = long-sighted program, and V = short-sighted program) in self and others that those emotional states' recalibrations were designed to affect.

† *Believable* intrapersonally targets the long-sighted program only for the Trustee.

‡ *Surprise* may either positively or negatively target the long-sighted program in one's self according to discovery that one has under- or over-expected achievement of the long-sighted program's goal.

Table 2: Details of Confirmatory Factor Analyses

Model	Specification	N	DF	Log-likelihood	Root Mean Square of Approximation	Comparative Fit Index	Bayesian Information Criteria	Difference in fit compared to Model R
1	Independent Valence Model: Zero (0) PA/NA Correlation	169	57	- 4,419.15	.144	.767	9,130.71	$Chi^2(6)= 147.47$ $p < .001$
2	Bipolar Valence Model: Negative (-1) PA/NA Correlation	169	57	-4, 371.49	.131	.808	9,035.39	$Chi^2(6)= 99.81$ $p < .001$
3	Unrestricted Valence Model: Unrestricted PA/NA Correlation	169	58	-4, 371.14	.131	.808	9,039.82	$Chi^2(5)= 99.46$ $p < .001$
R	Recalibrational Model: 5 Factors	169	63	-4, 271.68	.099	.892	8,866.55	

Note: One observation, where the participant reported the same value for all emotions was dropped.

Table 3: Details of Structural Equation Fit Analyses

Model	N	DF	Log-likelihood	Root Mean Square of Approximation	Comparative Fit Index	Bayesian Information Criteria	Difference in fit compared to Unrestricted Valence
Unrestricted Valence Model	169	62	- 4,784.99	.125	.799	9,888.03	
Recalibrational Model	169	69	- 4,681.98	.099	.880	9,717.92	$Chi^2(7)=103.01$ $p < .001$

Table 4: Structural Loadings and Equation Level Goodness of Fit for Valence and Recalibrational Models

Valence Model						***Recalibration Model***					
Structural		Beta		SE	R^2			Beta		SE	R^2
PA	S	.202	***	(.063)	.439	L1	S	.180	***	(.056)	.427
	L	.702	***	(.043)			L	.691	***	(.044)	
NA	S	-.335	***	(.065)	.328	L2	L	.644	***	(.068)	.415
	L	-.590	***	(.054)		L4	S	-.348	***	(.064)	.330
							L	-.589	***	(.054)	
						L5	L	-.199	**	(.082)	.039
Measurement		Beta/ Intercept		SE	R^2			Beta/ Intercept		SE	R^2
Appreciative	PA	.835	***	(.025)	.697		L1	.833	***	(.025)	.693
	Constant	1.105					Constant	1.135			
Happy	PA	.919	***	(.015)	.845		L1	.921	***	(.015)	.848
	Constant	1.408					Constant	1.439			
Content	PA	.831	***	(.026)	.690		L1	.832	***	(.026)	.693
	Constant	1.586					Constant	1.614			
Cheerful	PA	.876	***	(.020)	.767		L1	.873	***	(.021)	.761
	Constant	1.023					Constant	1.055			
Triumphant	PA	.795	***	(.030)	.632		L1	.793	***	(.030)	.629
	Constant	1.044					Constant	1.071			
Inspired	PA	.665	***	(.044)	.443		L1	.657	***	(.045)	.432
	Constant	.866					Constant	.893			
Secure	PA	.639	***	(.047)	.408		L1	.640	***	(.047)	.409
	Constant	1.441					Constant	1.461			
Believable	PA	.507	***	(.059)	.257		L2	.573	***	(.062)	.328
	Constant	1.373					Constant	1.418			
Proud	PA	.658	***	(.045)	.433		L2	.743	***	(.057)	.553
	Constant	1.256					Constant	1.314			
Disgusted	NA	.808	***	(.029)	.654		L4	.800	***	(.030)	.640
	Constant	2.107					Constant	2.104			
Jealous	NA	.507	***	(.059)	.258		L4	.510	***	(.059)	.260
	Constant	1.875					Constant	1.880			
Aggravated	NA	.901	***	(.018)	.812		L4	.907	***	(.017)	.823
	Constant	2.188					Constant	2.198			
Frustrated	NA	.885	***	(.020)	.782		L4	.889	***	(.019)	.791
	Constant	2.121					Constant	2.129			
Angry	NA	.870	***	(.021)	.758		L4	.873	***	(.021)	.763
	Constant	2.179					Constant	2.185			
Depressed	NA	.670	***	(.045)	.449		L4	.660	***	(.046)	.436
	Constant	2.129					Constant	2.124			
Sad	NA	.744	***	(.037)	.554		L4	.737	***	(.037)	.543
	Constant	2.114					Constant	2.111			
Embarrassed	NA	.430	***	(.066)	.185		L5	.679	***	(.049)	.461
	Constant	1.743					Constant	1.526			
Ashamed	NA	.115		(.079)	.013		L5	.902	***	(.035)	.814
	Constant	1.610					Constant	1.714			
Guilty	NA	.095		(.079)	.009		L5	.816	***	(.038)	.665
	Constant	1.496					Constant	1.598			

Note: Standardized beta reported. Equation level R^2 reported for each dependent variable.
* indicates statistical significance at $p < .10$, ** significant at $p < .05$, and *** at $p < .01$.